

B. Tech. Sem. I All Branch.

B.Tech. SEM -I ( Civil/ Electrical/ Mechanical/ Production/ Computer/  
Info. Tech. 2014 Course (CBCS) : SUMMER - 2019  
SUBJECT: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Day Wednesday  
Date: 15/05/2019

S-2019-2531

Time : 10.00 AM TO 01.00 PM  
Max. Marks : 60

N. B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagram **WHEREVER** necessary.
- 4) Assume suitable data, if necessary.

Q.1 a) An electric kettle is required to heat 2 litres of water from 25°C to 95°C in 20 minutes. Find the rating of the kettle assuming the efficiency of 80 %. If the kettle is to operate at 230 V, find the resistance of heating element. Assume the specific heat capacity of water to be 4200 J/kg°C and 1 litre of water to have mass of 1 kg. (05)

b) Derive the expression: (05)

$$\alpha_2 = \frac{\alpha_1}{1 + \alpha_1 (t_2 - t_1)}$$

OR

a) An electric furnace is to melt 50 kg of aluminium per hour, the initial temperature of the aluminium being 18°C. (05)

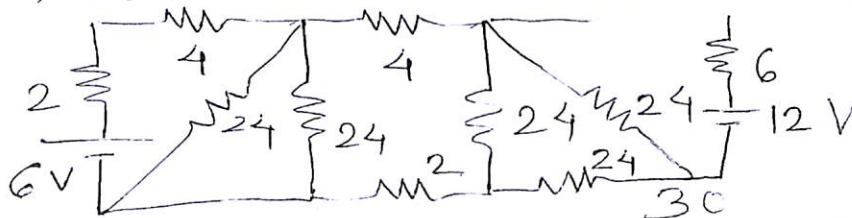
Calculate:

- i) The power required
- ii) Cost of operating the furnace for 20 hours. Aluminium has following properties:  
Specific heat capacity = 950 J / kg°C  
Melting Point = 660°C  
Specific latent heat of fusion = 450 kJ / kg

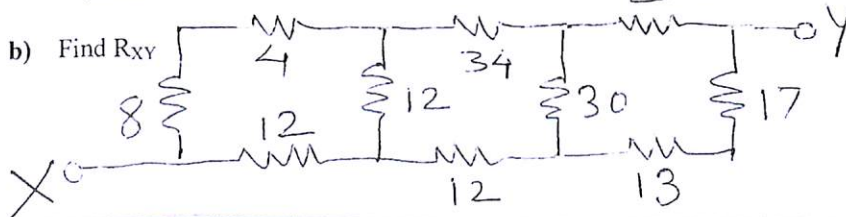
Assume the efficiency of the furnace to be 85 % and cost of energy to be 6 Rs/unit

b) Discuss the effect of temperature on pure metals. Alloys, Insulating materials. (05)  
Also draw the relevant graph.

Q.2 a) Using Superposition theorem, determine the current I as shown in network: (05)



b) Find  $R_{xy}$  (05)

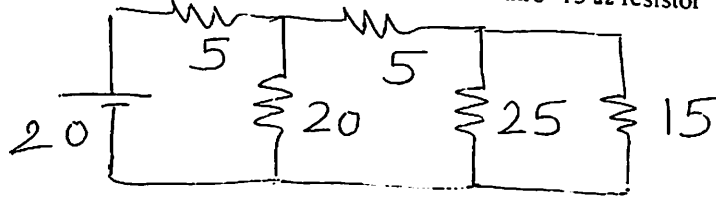


P. T. O.

OR

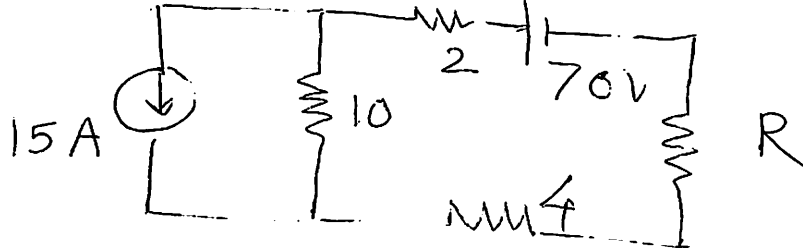
- a) Using Thevenin's theorem find current thro' 15  $\Omega$  resistor

(05)



- b) Find the value of R for maximum power transfer

(05)



- Q.3 a) Derive an expression for capacitance a parallel plate capacitor consisting of two slabs of different dielectric materials. (05)

- b) Three capacitors have capacitances 2  $\mu\text{F}$ , 4  $\mu\text{F}$  and 6  $\mu\text{F}$  respectively. Find the total capacitance when they are: (05)

- Connected in series
- Connected in parallel

OR

- a) A 5  $\mu\text{F}$  capacitor is charged to a potential of 110 V and then connected in parallel with uncharged 3  $\mu\text{F}$  capacitor. Calculate the potential difference across the parallel capacitors. (05)

- b) What is the time constant of a series RC circuit? Derive the expression for current flowing in the circuit. (05)

- Q.4 a) Compare magnetic and electric circuits. (05)

- b) A coil of 600 turns of resistance 20  $\Omega$  is wound uniformly over a steel ring of mean circumference of 30 cm and cross sectional area of 9  $\text{cm}^2$ . It is connected to supply of 200 V. If the relative permeability of a ring is 1600. Find: (05)

- The reluctance
- The magnetic field intensity
- The MMF
- The flux

OR

- a) Derive an EMF equation of 1-phase transformer. (05)

- b) A 600 kVA transformer has iron losses of 4 kW and half load copper losses are 2 kW. Calculate the efficiency of transformer at: (05)

- Half load 0.8 p.f. lagging
- Full load 0.8 p.f. lagging

- Q. 5** a) Define active, reactive and apparent power. Draw the power triangle. (05)
- b) The expression of the alternating current is given by  $i = 5.48 \sin \omega t$  (05)  
Calculate:
- The average value
  - The rms value of current
  - Power consumed if the current is passed through a resistance of  $10 \Omega$

**OR**

- a) Sketch and explain phasor diagrams of R-L-C series circuit when; (05)
- $X_L > X_C$
  - $X_L < X_C$
- b) Derive an expression for instantaneous current and power consumed when (05)  
voltage of  $v = V_m \sin (\omega t)$  is applied to pure inductance. Also draw phasor diagram.

- Q. 6** a) State various types of electrical wiring. Explain any one in detail. (05)
- b) Write a note on incandescent lamp. (05)

**OR**

- a) What is earthing? Explain the significance with diagram. (05)
- b) State and explain various components of electricity bill. (05)

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